

“the summit of a hill, Holderness, N. H.” was discovered in July, 1891, by Dr. R. C. Manning, Jr., who brought plants to the late Sereno Watson. These specimens are now preserved in the Gray Herbarium and, so far as the writer is informed, represent the only known station for the species in New Hampshire.

GRAY HERBARIUM.

NOTES ON NEW ENGLAND HEPATICAЕ,—VII.

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THE eight species discussed in the present paper include five distinct additions to the New England flora. The three remaining species have already been noted from New England, but their records have been either uncertain or incomplete. The North American species of *Cephaloziella*, two of which are mentioned below, are in need of further study, and it is probable that other members of this genus will eventually be detected in New England. It is difficult, however, to treat them fully at the present time because most of them occur also in Europe, and European writers still disagree about their limits and relationships.

1. METZGERIA FURCATA (L.) Dumort. Recueil d'Obs. sur les Jung. 26. 1835. *Jungermannia furcata* L. Sp. Plant. 1136. 1753. *Metzgeria glabra* Raddi, Mem. Soc. Ital. delle Sci. in Modena 18: 45. pl. 7, f. 1. 1818. On rocks and trees. Maine: Buckfield (*J. A. Allen*); Cumberland (*E. B. Chamberlain*). New Hampshire: Cornish (*Miss Haynes*); Jackson (*A. W. E.*). *Metzgeria furcata* was considered a common North American species until the publication of Lindberg's *Monographia Metzgeriae* in 1877.¹ The earlier writers accepted it in a broad sense and referred to it all the northern forms of the genus which were distinguished from *M. pubescens* by being destitute of cilia on the antical surface of the thallus. According to Lindberg the old *M. furcata*, as thus understood, was an aggregate and

¹ Acta Soc. Faun. Fl. Fenn. 1: 1-48. 2 pl. 1877.

he separated off, as distinct species, *M. conjugata*,¹ *M. hamata*, and *M. myriopoda*, largely on the basis of characters drawn from the structure of the thallus, the distribution and peculiarities of the marginal and postical cilia, and the nature of the inflorescence. He restricted the name *M. furcata* to what he described as the commonest of all European hepaticae but stated that he had never seen typical specimens of this species from North America. To *M. conjugata*, on the other hand, the only one of his new species which need now be considered, he ascribed a wide distribution on both sides of the Atlantic. Since this time the majority of writers, including such recent authorities as Stephani² and C. Müller,³ have accepted Lindberg's statements with regard to the absence of *M. furcata* from North America and have consequently considered *M. conjugata* as our common representative of the genus. In 1892, however, Miss Boatman⁴ recorded *M. furcata* from various localities in North America, extending from North Conway, New Hampshire (*James*), into Mexico, and Underwood⁵ soon afterwards published similar observations independently. On the basis of these records the species ought properly to have been included in the writer's Preliminary List of New England Hepaticae,⁶ but it was omitted because Underwood himself expressed some doubt as to the correctness of the determinations, most of which were based on thallus characters only. Apparently the specimens quoted above represent the species clearly, so that *M. furcata* may now be definitely reinstated as a member of our flora. Equally clear specimens have been examined also from Indian Brook, Cape Breton (*G. E. Nichols*), and from Onteora Mountain, New York (*Miss Vail*).

All writers agree that *M. furcata* and *M. conjugata* are very closely related. In both species the costa presents the same type of structure, being bounded above by two rows of cortical cells and below by from three to five rows. Lindberg finds the most important difference between the two plants in the inflorescence, *M. furcata* being dioicous and *M. conjugata* autoicous, but he also calls attention to differences in the structure of the thallus, to which he attaches considerable importance. In *M. furcata*, the less robust of the two, the thallus is said to be

¹ This species was first published in Acta Soc. Sci. Fenn. **10**: 495. 1875.

² Bull. de l'Herb. Boissier **7**: 941. 1899.

³ Rabenhorst's Kryptogamen-Flora **6**: 349. 1908.

⁴ Bull. De Pauw Sci. Assoc. **1**: 3. 1892.

⁵ Bull. Torrey Club **19**: 301. 1892.

⁶ RHODORA **5**: 170-173. 1903.

plane, the marginal cilia to occur singly, and the postical surface of the wings to be usually pilose. The marginal cilia are further distinguished by being slightly displaced to the postical surface and therefore not clearly visible from above. In *M. conjugata*, on the other hand, the thallus is said to be convex, the marginal cilia to occur frequently in pairs, and the postical surface of the wings to be practically free from cilia. Unfortunately, as Limpricht and others emphasize, most of these vegetative characters are subject to a good deal of variation, and it is not infrequent to find specimens in which the cilia are either sparingly developed or absent altogether. Even when present they do not always show the peculiarities of arrangement detailed above. Marginal cilia in pairs, for example, may occur in combination with scattered postical cilia, and wings of the thallus which are smooth on both surfaces may show marginal cilia borne singly. The position of these unpaired cilia, moreover, may also vary, being sometimes truly marginal and sometimes displaced to the postical surface. On account of the inconstancy of these vegetative characters Limpricht¹ was inclined to look upon *M. conjugata* as nothing more than a robust and normally developed form of *M. furcata*, due to a favorable environment, and Boulay,² still more recently, was unwilling to accord it more than subspecific rank. Most writers, however, accept both species without question, and this seems the wisest course to pursue since specimens with sexual branches usually show the specific characters clearly. The impossibility of determining all sterile material is by no means unusual in other genera of the hepaticae.

Although certain of the characters already mentioned are seen to be untrustworthy, *M. furcata* often produces peculiar organs of vegetative reproduction, which enable us to determine sterile specimens without difficulty. These organs have long been known but it is only lately that they have been at all emphasized from a taxonomic standpoint. They are in the form of marginal gemmae, or propagula, and are ovate to ligulate in outline according to the stage of their development. They are at first only one cell thick throughout but usually acquire a median costa sooner or later. The gemmae are frequently developed in great abundance, and Goebel³ considers their production to be a direct result of unfavorable conditions. Lindberg described these

¹ Cohn, Krypt.-Flora von Schlesien 1: 441. 1876.

² Musc. de la France 2: 170. 1904.

³ Flora 83: 69-74. 1898.

marginal gemmae clearly for *M. furcata* but made no allusion to them in his description of *M. conjugata*, thus implying that they did not occur in this species. Goebel¹ goes still farther; he associates marginal "adventive branches" definitely with *M. furcata*, and says that *M. conjugata* is characterized by the occasional production of gemmae of an entirely different type. Miss Boatman, to be sure, describes marginal gemmae for *M. conjugata*, but her statements have not been confirmed by subsequent writers and it seems probable that her descriptions were not drawn from the true *M. conjugata*. On the whole the evidence at present appears to indicate that the marginal gemmae of *M. furcata* yield important differential characters, and it seems safe to assume that such gemmae do not occur in *M. conjugata*. The writer hopes to discuss the vegetative reproduction of *Metzgeria* more fully in another connection.

2. ***Metzgeria crassipilis*** (Lindb.) sp. nov. *Metzgeria furcata*, subsp. *Metzgeria crassipilis* Lindb. Acta Soc. Faun. Fl. Fenn. 1: 42, 1877. On rocks. Vermont: Lake Dunmore (*W. G. Farlow*). Connecticut: New Haven (*D. C. Eaton*); Orange (*J. T. Phinney*). Although Lindberg, as already noted, saw no specimens of typical *M. furcata* from North America, he described a peculiar plant from the eastern United States under the above name, including it under *M. furcata* as a subspecies. He was able to study two specimens of this plant, one from Laurel Hill, Pennsylvania (*Sullivan*), and the other from Ben Lomond, Warren County, Tennessee (*Fredriksson*). Neither of these specimens has been accessible to the writer, but Lindberg's description is so detailed and so clear that there can be but little doubt as to the correctness of the above determinations. For some strange reason *M. crassipilis* has been completely overlooked or ignored since its original publication but it is amply distinct from *M. furcata*, and Lindberg would undoubtedly have described it as a distinct species if he had had a more liberal supply of material at his disposal. It has a fairly wide distribution and the following localities, outside of New England, may also be recorded. New York: Chilson Lake (*Mrs. Smith*); Little Moose Lake (*Miss Haynes*); Shandakan (*Miss Miller*). West Virginia: Seebert and Warntown (*J. L. Sheldon*). Virginia: Nick's Creek and Walker's Mountain (*J. K. Small*); Dickey's Creek and Hungry Mother Creek (*Mrs. Britton and Miss*

¹ Organographie der Pflanzen 275. 1898.

Vail). North Carolina: Blowing Rock Mountain (*J. K. Small*); Hog Back Mountain (*H. A. Green*).¹

In its dioicous inflorescence *M. crassipilis* agrees with *M. furcata*, and the costa is built up on the same type in the two species. The thallus of *M. crassipilis*, however, is more or less convex, the postical surface of the wings is usually densely pilose, and the marginal cilia (although occurring singly) are not displaced to the postical surface. The cells of the thallus, also, average less than $35\ \mu$ in diameter, whereas in *M. furcata* they average more than $35\ \mu$. But the most remarkable structures found in *M. crassipilis* are the gemmae. These are frequently produced in great abundance and arise on the antical surface of the wings and not on the postical surface as Lindberg described. Each gemma is in the form of a circular disc, one cell thick throughout and usually showing a single two-sided apical cell. The surface of the gemma is smooth but the margin usually bears a few straight cilia, irregularly distributed. The gemmiparous branch is not strongly modified in appearance, but the development of the gemmae tends to limit its growth. Lindberg describes the female branch as being smooth, but it shows this condition only when immature; as it grows older it becomes sparingly setose or pilose along the margin and occasionally develops a very few short surface cilia. The antheridial branch is smooth, and the calyptra and sporophyte are still unknown.

According to Lindberg *M. crassipilis* is to a certain extent intermediate between *M. furcata* and *M. dichotoma* (Swartz) Nees, a tropical species known from the West Indies and Brazil. In *M. dichotoma*, which is rather more robust than *M. crassipilis*, the costa is bounded above by from three to five cells and below by from five to eight, the cells average about $50\ \mu$ in diameter, the cilia are longer and more abundant, and the female branch is pilose. The gemmae of *M. dichotoma*, so far as Lindberg describes them, are similar to those of *M. crassipilis* and also arise from the surface of the thallus-wings.

3. PELLIA FABRONIANA Raddi, Mem. Soc. Ital. delle Sci. in Modena **18**: 49. pl. 7. f. 5. 1818. *Jungermannia calycina* Tayl.; Mackay, Fl. Hibern. **2**: 55. 1836. *Pellia calycina* Nees, Naturgeschichte der europ. Leberm. **3**: 386. 1838. Wet bank of brook; Newfane, Vermont (*A. J. Grout*). The species is sometimes known as *P.*

¹ The specimens from several of these localities have been listed elsewhere as *M. conjugata*. See Mem. Torrey Club **4**: 195. 1893. Also Adirondack League Club Year Book for 1904: 45.

endiviaefolia (Dicks.) Dumort. The original *Jungermannia endiviaefolia* of Dickson (Pl. Crypt. Brit. 4: 19. 1801) was apparently based on an old figure of Vaillant, and there is so much uncertainty about it that most of the recent European writers have given it up in favor of the later name of Raddi, about which there seems to be no doubt. In the Bryologist for May, 1905, Grout refers his specimens with some hesitation to *P. Neesiana* (Gottsche) Limpr. Since they are entirely destitute of mature capsules their determination is beset with difficulties and we are obliged to rely on characters derived from the thallus. Fortunately the internal cells of the median region afford structural differences which are available even in sterile material. In *P. Neesiana*, as well as in *P. epiphylla* (L.) Corda, many of these cells show vertical bands of thickening in their walls, and these bands are often pigmented with purple or red. They can be most easily demonstrated by cutting longitudinal sections through the thallus, although they are sometimes seen almost as clearly in transverse section. In *P. Fabroniana* bands of this character are not developed, the cells of the thallus being everywhere thin-walled. Since Grout's specimens are also destitute of these bands they are here referred to *P. Fabroniana* instead of to *P. Neesiana*. Comparatively few of the publications relating to *Pellia* make use of these bands in distinguishing the species, although attention was called to them many years ago by Leitgeb.¹ C. Müller,² however, emphasizes their importance and gives an excellent figure of them as they appear in *P. epiphylla*.

4. PELLIA NEESIANA (Gottsche) Limpr.; Cohn, Krypt.-Flora von Schlesien 1: 329. 1876. *Pellia epiphylla*, forma *Neesiana* Gottsche, Hedwigia 6: 69. 1867. On wet rocks; Wintergreen Falls, Hamden, Connecticut (A. W. E.). The species is probably widely distributed in New England but is easily confused with *P. epiphylla*. All three species of the genus are common in Europe and Asia. The striking difference in the structure of the thallus, which separates *P. Neesiana* from *P. Fabroniana*, is supplemented by still more striking differences in the structure of the capsule. In *P. Neesiana* the cells forming the inner layer of the capsule-wall develop local wall-thickenings in the form of incomplete rings; the elater-bearers at the base of the capsule are 15–25 μ in diameter and number from 20 to 30; while the elaters

¹ Unters. über Lebermoose 3: 53 (footnote). 1877.

² Rabenhorst's Kryptogamen-Flora 6: 9. f. 2. 1906.

themselves are about $8\ \mu$ in diameter and show two spirals. In *P. Fabroniana*, on the other hand, the inner layer of the capsule-wall is without local thickenings; the elater-bearers are only $5\text{--}8\ \mu$ in diameter and number about 100; while the elaters themselves are $10\text{--}12\ \mu$ in diameter and show three or four spirals. The differences in the structure of the capsule are fully discussed by Jack.¹

The relationships between *P. Neesiana* and *P. epiphylla* are very close indeed, both thallus and capsule showing the same structure in the two species. There are, however, two important differences between them. In *P. Neesiana* the inflorescence is dioicous, and the involucre is in the form of a short but complete sheath with an irregular margin. In *P. epiphylla* the inflorescence is monoicous (paroicous), and the involucre is represented by a short flap of the thallus on the basal side of the sporophyte. *P. Fabroniana* agrees with *P. Neesiana* in being dioicous and in developing a tubular involucre, but the latter is long and extends beyond the calyptra, whereas in *P. Neesiana* the calyptra extends beyond the involucre at maturity. The differences just noted are very clearly shown by C. Müller¹ in a series of schematic figures.² It will be seen from the foregoing statements that sterile specimens of *Pellia* with bands of thickening in the internal cells of the thallus are quite indeterminable.

5. CEPHALOZIELLA ELACHISTA (Jack) Schiffn. Lotos **48**: 338. 1900. *Jungermannia elachista* Jack; Gottsche & Rabenhorst, Hep. Europ. *574* (with figures). 1873. *Cephalozia elachista* Lindb. Acta Soc. Sci. Fenn. **10**: 502. 1875. On a decayed stump in a bog; Reading, Massachusetts (*C. C. Kingman*). Not before recorded for America. Widely distributed in Europe but apparently rare. This delicate little species seems to be confined to bogs and is characterized primarily by an autoicous inflorescence and by distant, sparingly dentate leaves. The plant is pale green in color and the prostrate stems are sparingly branched. The deeply bifid leaves are almost transversely inserted and tend to spread widely from the axis. Their lobes are slender and sharp-pointed, usually from four to six cells long and from two to four cells wide at the base, and they are frequently inflexed at the apex. The leaf-cells have a smooth cuticle and are thin-walled; in the middle of the lobes they measure $19\text{--}24\ \mu$ in length

¹ Flora **81** (Ergänz.-Band): 1-16. *pl. 1*. 1895.

² Rabenhorst's Kryptogamen-Flora **6**: 369. *f. 218*. 1908

by about 12μ in width. The marginal teeth are sometimes absent altogether, and it is rare to find more than one tooth on a lobe, consisting usually of a single projecting cell. The underleaves are minute and are not always present. The lobes of the perigonial bracts are toothed, but the teeth are more numerous and better developed on the perichaetial bracts; they differ in length and extend irregularly in various directions. The perianth is long and in the form of a triangular prism, minutely crenulate at the mouth from projecting cells. Gemmae are frequently present and are usually borne at the tips of more or less elongated branches where they form spherical masses. They are elliptical in form with thin walls and rounded ends; they measure about $17 \times 9 \mu$ and are usually bicellular. As a rule it is quite impossible to distinguish leaves in the gemmiparous region, although this is not always the case.

The original specimens of *Jungermannia elachista*, collected by Jack at Salem in Baden and distributed by Gottsche and Rabenhorst, are badly mixed with a second species of *Cephaloziella*, which Schiffner refers to *C. byssacea* (Roth) Schiffn. (= the *C. divaricata* of many authors). In the set of the Hepaticae Europaeae in the Eaton herbarium, No. 574 is made up almost entirely of this second species, but the few sterile stems which seem referable to *J. elachista* agree with the Massachusetts specimens. The range of variation and the relationships of the species are not yet clearly understood.

6. CEPHALOZIELLA HAMPEANA (Nees) Schiffn. Oesterr. Bot. Zeitschr. **54**: 256. 1904. *Jungermannia Hampeana* Nees, Naturgeschichte der europ. Leberm. **3**: 560. 1838. *Cephaloziella trivialis* Schiffn. Lotos **48**: 341. 1900. *C. erosa* Limpr.; Warnstorf, Kryptogamenfl. der Mark Brandenburg **1**: 233. f. 6. 1902. *Cephalozia erosa* Massal. Malpighia **21**: 36. 1907. On a rotten log in a swamp; near Schoodic Lake, Piscataquis County, Maine (A. W. E.). On moist rocks; Naugatuck, Connecticut (A. W. E.), sterile; specimens with male and female flowers afterwards collected in the same locality by Miss Lorenz. Not before recorded from North America but widely distributed in Europe. The above synonymy is mostly quoted from Schiffner, who suggests that it be accepted somewhat tentatively, the relationships between the present species and the closely allied *C. bifida* (Schreb.) Schiffn. being not yet definitely established. The specimens which are here referred to *C. Hampeana* agree closely with the type material of *C. trivialis*, collected by Dreesen

near Bonn and distributed in Gottsche and Rabenhorst's *Hepaticae Europaeae*, No. 598, under the name *Jungermannia divaricata*. They are deep green in color with occasionally a tinge of brownish. The stems are sparingly and irregularly branched, while the leaves are distant and widely spreading with broad triangular lobes acute at the apex. The lobes are usually from eight to twelve cells long and from six to ten cells wide at the base; their margins are either entire or vaguely and irregularly crenulate. The leaf-cells average about $15 \times 11 \mu$ and have thin walls. Underleaves may or may not be present. The inflorescence is autoicous. The female branch varies more or less in length but is usually elongated, and the leaves gradually increase in size toward the archegonia. The lobes of the bracts are sometimes entire or nearly so and sometimes minutely and irregularly denticulate. The lobes of the perigonal bracts also show minute teeth or crenulations occasionally but are more frequently entire. Gemmae are sometimes very abundant and closely resemble those described for *C. elachista*.

As thus described *C. Hampeana* is a variable species agreeing with *C. elachista* in its autoicous inflorescence. It is, however, more robust, the lobes of its leaves are broader and less sharp-pointed, the leaf-cells are smaller, and the margins of both leaves and bracts are less toothed. When Schiffner first published his *C. trivialis* he suggested that the *Cephalozia divaricata* described by Heeg¹ might also be regarded as a synonym. Warnstorff² considers this open to doubt from the fact that Heeg's plant seems to be distinctly dioicous, and Schiffner has made no further allusions to the matter in his more recent papers. Heeg's species differs from the true *C. divaricata*, as understood by Schiffner and others, and has not yet been definitely reported from North America. The various ways in which *C. divaricata* is interpreted by European botanists is discussed by Miss Lorenz³ in a recent publication.

7. CALYPOGEIA NEESIANA (Massal. & Carest.) C. Müll. Frib.; Loeske, Verhandl. Bot. Ver. Prov. Brandenburg **47**: 320. 1905. *Kantia Trichomanis*, β *Neesiana* Massal. & Carest. Nuovo Giorn. Bot. Ital. **12**: 351. pl. 11, f. 3. 1880. *Calypogeia Trichomanis*, var. *Neesiana* C. Müll. Frib. Beih. zum Bot. Centralbl. **10**: 217. 1901. *Cincinnulus Trichomanis*, var. *Neesiana* C. Müll. Frib. *ibid.* **13**: 97.

¹ Verhandl. der k. k. zool.-bot. Gesellsch. in Wien **43**: 95. 1893.

² Kryptogamenfl. der Mark Brandenburg **1**: 227. 1902

³ Bryologist **12**: 25-27. 1909.

1902. *Kantia Neesiana* Migula, Kryptogamen-Fl. von Deutschland, etc. 1: 462. 1904. *Calypogeia integristipula* Steph. Bull. de l'Herb. Boissier II. 8: 662. 1908. On rotting logs in a cedar bog; Monkton, Vermont (*L. W. Riddle*). Not before recorded from North America but probably with an extensive range. Widely distributed in Europe and northern Asia. Although *C. Neesiana* has been considered a mere form or variety of *C. Trichomanis* until very lately, European writers are now showing a marked tendency to accept it as a valid species. It is a robust plant, equalling *C. Trichomanis* in size, and is characterized by oval leaves, rounded or truncate at the apex, and by large orbicular or reniform underleaves, usually quite undivided but sometimes emarginate or bluntly bifid to about one fourth, these various conditions being often found on a single stem. The underleaves are further distinguished by their more or less elongated cells with thin walls. Unfortunately, as in other members of this difficult genus, many of the slender and sterile stems fail to show the characters of the species clearly, but well developed plants are not difficult to determine. In a recent paper Meylan¹ discusses *C. Neesiana* fully and concludes that its characters are much more constant than those of *C. fissa* Raddi, which most botanists now recognize as a species; he emphasizes, however, its very close relationship to *C. Trichomanis*.

8. SCAPANIA GLAUCEOCEPHALA (Tayl.) Aust. Bull. Torrey Club 6: 85. 1876. *Jungermannia glaucocephala* Tayl. Lond. Jour. Bot. 5: 277. 1846. *Scapania Peckii* Aust. Proc. Acad. Philadelphia for 1869: 218. On a rotten log; Waterville, New Hampshire (*Miss Lorenz*). Although the present plant has been quoted from New England this is the only definite station which the writer is able to cite. The species is peculiar to North America and its known range extends westward to Minnesota and northward into Canada. Its most important peculiarities have already been noted in connection with the closely related *S. apiculata* Spruce,² but it may be well to allude to them briefly again. It is characterized especially by its upright flagelliform shoots bearing gemmae in abundance. These are oval and usually unicellular and are deeply pigmented with brown or purple. The leaves upon which the gemmae are borne have thick-walled cells without distinct trigones. The normal leaf-cells are much smaller

¹ Rev. Bryol. 36: 53-58. 1909.

² RHODORA 9: 71. 1907.

and are thin-walled throughout or with very minute trigones. The gemmiparous shoots bear a marked resemblance to those found in *Sphenolobus Hellerianus* but are considerable larger. According to C. Müller¹ the perianth is still unknown. Austin, however, describes it for his *S. Peckii*, and it is figured by Pearson.² The species is evidently in need of further study.

The following represent additions to local state floras not included in the preceding notes:— *Calypogeia tenuis*, Reading, Massachusetts (C. C. Kingman); *Cephalozia pleniceps*, Willoughby, Vermont (Miss Lorenz); *Cephaloziella myriantha*, Biddeford Pool, Maine (Miss Lorenz); *Cololejeunea Biddlecomiae*, Buckfield, Maine (J. A. Allen); *Lepidozia sylvatica*, Cape Elizabeth, Maine (A. W. E.); *Lophozia confertifolia*, Mount Mansfield, Vermont (Miss Lorenz); *L. longiflora*, Mount Lafayette and Carragain Pond, New Hampshire (Miss Lorenz); *Scapania gracilis*, Madison, New Hampshire (H. H. Bartlett); *Sphenolobus Hellerianus*, Willoughby, Vermont (Miss Lorenz); *S. Michauxii*, Mount Greylock, Massachusetts (A. LeRoy Andrews). From specimens sent by C. C. Kingman the Massachusetts records for *Chiloscyphus pallescens* and *Anthoceros punctatus* may now be marked with the sign “+”.

The census of New England Hepaticae now stands as follows: Total number of species recorded, 155; number recorded from Maine, 106; from New Hampshire, 120; from Vermont, 90; from Massachusetts, 85; from Rhode Island, 64; from Connecticut, 110; common to all six states, 43.

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¹ Nova Acta Acad. Caes. Leop. Carol. **83**: 264. 1905.

² List of Canadian Hepat. *pl.* 8. 1890.